


### Amendment to Specification

Applicant respectfully requests amendment to the specification without the addition of new subject matter. Additions thereto are underlined.

Page 2, line 12 after the second paragraph insert following two paragraphs:

The principle of the new mixing process is based on a new receptivity. The new invention uses both, new passive and active controls of fluid flow to achieve an extraordinary rapid and homogeneous mixing of fluids. The active forcing not only enhances the primary vortices due to the primary inherent instability, but also the secondary stream-wise vortices due to secondary instability mechanisms, e.g. the instability of streamwise vortices resulted from the interactions of streamwise corner vortices of corner flow leaving the trailing edge between splitter plate and the side wall, and the primary spanwise vortex.

 The corner flows here mean the local flows having streamwise vorticity in the corners between two solid walls intersecting with an angle from each other. For instance, there are corner flows in the corner between a splitter plate and sidewall in a pipe if the splitter plate is placed inside the pipe and connected to the sidewall of the pipe to separate two fluid streams. When the vorticity is large in the corner flow, there is a streamwise vortex. This streamwise vortex can exist upstream and downstream of the trailing edge of the splitter plate. The streamwise vortex can be enhanced in a confined configuration and under periodic forcing in the flows with a large receptivity. The receptivity describes how much external forcing energy is absorbed by a system and converted to velocity fluctuation of a flow. The increase of the velocity fluctuation can enhance primary (spanwise) and secondary (streamwise) vortices, which in turn, enhance the mixing. The larger the receptivity is, the stronger the mixing is. The confined configuration indicates a three-dimensional flow compared to a two-dimensional flow of a larger spanwise homogeneity.

## Discussion of Claims

It can be summarized that Examiner states that claims 23 to 24 are rejected as being unpatentable under 35 U.S.C. 112 first paragraph and second paragraph, and 35 U.S.C. 102(b).

### ***Action 4-12 relevant to 35 U.S.C. 112 first paragraph and second paragraph***

To enable one skilled in the art to which the claims pertain, to make and/or use the invention, the inventor has added some introduction and explanation in the sections of claims and specification without the addition of new subject matter as shown above. This explains the receptivity and could help to find the optimized specific narrow frequency band through tuning the frequency of the actuator until the strong mixing is achieved. The concepts of "corner flow" and the specific narrow frequency band are also given in the new additions.

### ***Action 13-14 relevant to 35 U.S.C. 102(b)***

Applicant has carefully read the three patents from Cottel et al (US Re. 25,324) and the other two, which the examiner has sent to applicant. There is fundamental difference between the present invention and the one from Cottel et al and others. Here are some examples.

- (1) In the invention from Cottel et al, the blade is free to vibrate at its own frequency without support along its sharpened edge (col. 2, line 21-23), similar to the patent of Jacobs III (3,408,050). The present invention, however, does not necessarily require the vibration of the blade at all. The blade can be fixed and not movable. In the experiment that leads to the invention, the splitter plate is actually fixed.
- (2) To achieve the vibration, jet is required in the patent of Cottel et al, which could in turn need high-speed flow of turbulence. But in the present patent, the flow velocity can be very low and the flow can be initially laminar.
- (3) The present invention requires **external periodic forcing** to induce "receptivity", and this is not the mechanism of mixing enhancement and was also not mentioned and claimed in the patent of Cottel et al.

(4) The invention of Cottel et al claimed acoustic vibration of the blade, which indicates that the vibration frequency of the blade is at least higher than 20 Hz (normally the acoustic wave corresponds frequency higher than 20 Hz). The present invention does not necessarily require acoustic vibration, the forcing frequency can be smaller than 7 Hz as we have observed in our experiment.

(5) In the patent of Cottel et al, there could be no the corner flow and the corresponding streamwise vortices of the interest of the present patent, since the jet flow is introduced from the side of the blade. The side jet results in a flow that is quite different from that of the present invention. Therefore, the corresponding instability mechanism and receptivity should also be different. The confined configuration to enhance the streamwise vortices and the receptivity for mixing enhancement for the present invention was not described and claimed in the patent of Cottel et al.

Similarly the mechanism of the present patent is not applied to and claimed in the other two patents.

#### **New address and contact information**

Applicant inform to THE UNITED STATES PATENT AND TRADEMARKS OFFICE  
the new contact address as following:

\*\*\*\*\*

Guiren Wang

7804 Regent Place, # 8

Huntsville, AL 35802

USA

Phone: (256) 726-4987; Fax: (256) 726-4806

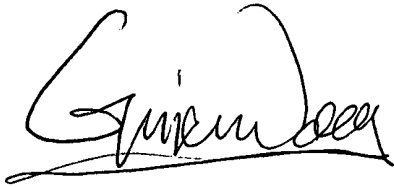
Email: guirenwang@yahoo.com

\*\*\*\*\*

**Conclusion**

Applicant respectfully states that the application is now in a condition for immediate allowance and respectfully solicits same.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Guiren Wang', with a horizontal line drawn underneath the signature.

Applicant  
Guiren Wang  
7804 Regent Place, # 8  
Huntsville, AL 35802  
USA